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Economic Analysis of Beneficiaries of Fadama II Project in Sardauna Local Government Area of Taraba State, Nigeria

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***Abstract* – The study examined the economic analysis of Beneficiaries ofFadama II Project in Sardauna Local Government Area of Taraba State, Nigeria. A total of 75 Fadama II Project loan Beneficiaries were randomly selected in the study area. Data were collected using structured questionnaires and analysis was done using descriptive statistics, Farm budgeting and Regression analysis. Farm budget analysis revealed the net farm income of ₦168, 985.85/ha for Beneficiaries. The return on Naira invested per hectare used by Fadama II Beneficiaries was₦ 2.33. The double-log function revealed that seed inputs used by the Beneficiaries was significant at (P<0.05). The coefficients of determination (R^2) of Fadama II Beneficiaries was 53.67% implying that, the percentages of the variation in the dependent variables (yield) that was explained by variation in explanatory variables; seed, fertilizer, chemical, labour and farm size included in the model for the groups of the farmers. The remaining proposition may be due to variation in the production techniques and other factors not included in the model (error or random disturbance). The efficiency of fertilizer and chemical were below economic optimum level for Beneficiaries while labour, farm size and seed were above the level. Some of the constraint of fadama farming in the study area include: High cost of input, land fragmentation, high cost of transportation among others. It is therefore concluded that to optimize profit, there is need for Beneficiaries to use less of labour, seeds and farm size while reduce chemical and fertilizer usage. The study recommends resource adjustment in order to increase output by the farmers and loan should be made available and accessible.Efforts should be geared by the government and other stake-holders towards providing fadama lands to farmers on soft conditions as regards land leasing agreement.**

***Keywords* – Analysis, Beneficiaries, Economic, Fadama II, Project.**

I. INTRODUCTION

To tackle the factors militating against agricultural development in Nigeria, government initiated programmes aimed at improving agricultural production. Among these programmes is: Agricultural Development Projects (ADPs) established in 1975. The Agricultural Development Project (ADP) approach was aimed at increasing agricultural production in the smallholder sector, comprising the bulk of the rural farming populace. The National Fadama Development Project has been one of the most important components of the Agricultural Development Programme.

In most parts of the world, especially in the arid and semi-arid regions, access to irrigation is the key to reducing the impact of climate variability and change on food security and regional economies. Irrigation farming is one of the most important rural development investments that can have both direct and indirect impacts on poverty and food security in semi-arid tropical countries Ajala[1],Bhattarai and Narayanamoorthy [2]. At the moment, climate change represents an additional challenge to rain fed farming and a further reason for investment in irrigation farming. Smallholder farmers and pastoralists are among the most vulnerable to the impact of climate change. This justified the inclusion of the Fadama component in the overall project objectives of the early generation ADPs to develop small scale irrigation system for agricultural production.

The irrigation technologies involved the use of drilled wells and petrol driven water pumps. It was found to be more efficient than the large scale irrigation scheme because the small scale irrigation average cost is approximately $1,000 per hectare while the large scale irrigation schemes average cost is approximately $10,000 per hectare [3]

Fadama is a “Hausa” word meaning low-lying alluvial land partially or completely flooded during the wet season where crop production is carried out during both wet and dry seasons, making use of some residual moisture and occasionally supplemented with irrigation[4]. For many successive governments in Nigeria, enhancing Fadama land productivity is a major priority aimed at boosting food production. To exploit the benefit associated withFadama land productivity, the federal government in collaboration with the World Bank, agreed to pursue a comprehensive package to encourage fadama farming endeavours. The National Fadama Development Project I (NFDP-I) became a component of some northern states ADPs.

One of the major success stories of NFDP-I was the adoption of simple, low cost improved irrigation technology by farmers which included motorized pumps and tube wells. This resulted in improved agricultural activities of the participating communities as well as their social and economic well-being [5].

The second phase of the project called National Fadama Development Project II (NFDP-II) was designed based on the lessons learned from Fadama I, these lessons were; i). Helped producers increased output without emphasis on storage and marketing of their surplus. ii). There was limited advisory service, raising concern about the project sustainability. iii). Fadama 1 narrowly focused on crop production, neglecting opportunities to add value through

processing and other activities.iv). It also failed to fully recognize and enhance the contribution of women to rural economy. In order to resolve these lessons, the design of Fadama II project included downstream activities such as marketing, processing, infrastructural development as well as participation of all stakeholders, i.e, Federal, State, Local Government and the participating fadama users Association (FUAs). Another notable innovation in the fadama II model was inclusion of Local Development Plan (LDP). The project targeted the development of small scale irrigation, especially in the low-lying alluvial flood plains or "Fadama". It was intended to increase the productivity, income, living standards and development capacity of the economically active rural communities while increasing efficiency in delivering implementation services to an estimated four million rural beneficiary households, of NFDP II participating states, namely, Taraba, Adamawa, Bauchi,Gombe, Kaduna, Niger, Ogun, Oyo, Lagos, Imo, Kebbi and FCT [6].

For successful implementation of National Fadama Development Project II, the funding institutions mandated Taraba State Agricultural Development Programme (TADP) and other states, who benefited under the auspices of NFDP-II to organize farmers into groups to be known as the Fadama Users Associations (FUAs). The formation of FUAs grouped the Fadama farmers into manageable units and served as a link between Fadama farmers and the state implementing agencies. FUAs are non-governmental, non-political groups formed on the basis of free- will among farmers and they had well developed aims and objectives. Thus, the focus of this studyis on the economic gains or otherwise of Beneficiaries in comparison with Non-beneficiaries of FadamaDevelopment Project II.

Poverty is prevalent in Nigeria and Taraba State in particular. The spread and severity of poverty which is more in the rural areas is of great concern to many nationsthe world over of which Nigeria is not an exemption. Hence the need to alleviate it arises. National Fadama II Development Project which is a community driven development project in Nigeria aims to reduce poverty by supporting communities to acquire infrastructure and productive assets, providing demand-driven advisory services, increasing their capacity to manage economic activities and reducing conflict among resource users.

This study was conducted to examine the economic analysis of vegetable production by Beneficiaries of Fadama II project in Sardauna L.G.A of Taraba State, Nigeria in order to determine how the project succeeded in targeting the poor farmers in its effort to reduce poverty.This study seek to:Estimate the cost and returns of fadamaII Project beneficiaries in the study area, Assess the resource use efficiency ofBeneficiaries of fadama II project and Identify constraints of fadama II project Implementation in the study area.

II. METHODOLOGY

The study was conducted in Sardauna Local Government (Mambilla Plateau) of Taraba State. The local government lies between latitude 6.7138Nlongitude 11.2500E of the equator. It is the highland region located in the extreme south east of Taraba State in Nigeria. The Mambilla Plateau has its south and eastern escarpment standing along the Cameroonian border, while the remainder of its giant northern escarpment and western slope are in Nigeria. Mambilla Plateau has an average elevation of 1,348m (4,423ft) above sea level [7].

In contrast to the rather steamy and humid climate of most other part of south eastern Nigeria with distinct dry and rainy seasons, the climate in this area, owing to its altitude is relatively cool, the day time temperature hardly exceeds 25^{0C} (77.0^{0f}) and strong wind prevails during the day time. The rainy season commences from mid-march and ends in December while dry season starts end of December to mid-March. Mambilla Plateau receives over 1850mm of rain fall annually [8].

According to 2006 Census, Sardauna Local Government has a human population of 224,437. The major ethnic groups on the plateau include: Mambilla, Kaka, Fulani, Panso and Kambu. Hausa, Igbo and Kanuri also live there. Mambilla and Fulani are the common languages spoken in GembuHeadquarter of Sardauna Local Government of Taraba State.

The study utilized structured questionnaire to obtain primary data from field survey conducted during 2010-2011 production year. Multistage random sampling technique was used in the selection of the respondents. In the first stage 3 Districts namely, Kabri,Gembu and Nguroje were randomly selected.In the second stage, 5 villages were randomly selected from each of the 3 Districts. In Kabri District, the villages are: Dorofi, Chana, Kabri-songbariki, Mayo-dule and Kune. In Nguroje District, the selected villages are: Maisamari, Yerimaru, Nguroje, Kakara and Galadima while GembuDistirct comprised of Titong, Mayo-ndaga, Leme, Wuro-ardo and Lekki-taba. The list of Beneficiaries was obtained from the Local Fadama Desk Office. In the final stage, 5 Beneficiaries were randomly selected from each of the 15 villages making a total of 75 respondents. Also 5 Non-beneficiaries not in proximity with the Beneficiaries were purposively selected from each of the 15 villages making a total of 75 respondents.

Primary data were collected from Beneficiaries and Non-beneficiaries of Fadamavegetable (Tomato, Sweet papper, Okra, Cabbage, Spinach, Amaranthus, and Garden egg) farmers through questionnaire that was administered by the enumerators and the researcher. The enumerators were specially trained for the purpose of collecting the data on fadama activities of Beneficiaries and Non-beneficiaries.

The secondary data(list of the Beneficiaries, items procured for Beneficiariesetc) were generated from local fadama desk office, state fadama coordinating office and zonal headquarters. Other sources were textbooks, internet materials, proceeding of conferences, among others.

Analytical Techniques

The analytical techniques used for achieving the objectives of the study were descriptive statistics and regression analyses. The multiple regression model was

used to determine which of them provided the best fit for the relationship of the parameters specified in the models, the profit function with respect to the production inputs used by the Beneficiaries of Fadama II in the study area; and specification of gross-margin, net farm income and farm financial ratio analysis to determine the profitability level of farms in the study area. The models are specified as follows:

Descriptive statistics

The descriptive statistics such as frequency and percentage were used to identify the major constraints facing the beneficiaries of Fadama II project.

It is expressed as:

$$Y = \frac{FR}{N} \times 100 \quad (1)$$

Where,

Y = the parameter (variable) being examined

FR= Frequency of Response

N = Sample Size

Gross Margin analysis

Gross margin (GM) of an enterprise is the difference between the revenue and the variable cost of single unit. The gross margin is very useful in planning of any enterprise especially in situation where fixed capital form a negligible portion, for instance in subsistence agriculture [9].

The goss margin is calculated using the following formula:

$$GM = GI - VC \quad (2)$$

Where, GM = Gross margin

GI = Gross income

VC = Variable cost

Net farm income (NFI)

The net farm income is the difference between gross farm income and the total cost of production using the following formula:

$$NFI = TR - TC \quad (3)$$

Where, NFI = net farm income

TR = Total revenue

TC = Total cost

The fixed cost includedepreciation of farm equipment using the straight line method:

$$\text{Depreciation} = \frac{P - S}{N} \quad (4)$$

Where, P = Purchased price

S = Salvage value

N = Number of useful years of the assets

Farm financial analysis

The farm financial ratios were used to determine the profitability of vegetable production which is the objective II of this study. Therefore, it becomes necessary to examine the three ratios (gross, operating and fixed) which are also obtained from the net income statement (cost and returns).

Gross ratio

This ratio expresses the percentage of gross income absorbed by the total cost [10] and is expressed thus:

$$GR = \frac{TC}{GI} \quad (5)$$

Where;

GR = Gross ratio

TC = Total cost

GI = Gross income

The ratio represents the proportion of cost absorbed by operation out of the gross profit. In addition, gross ratio measures the ultimate success of the farm business. A ratio less than 1 is desirable for any business.

Operating Ratio

This is the proportion of the gross income that goes to pay for operating cost, which is directly related to the variable input expenses of the farm.

$$OR = \frac{TVC}{GI} \quad (6)$$

Where;

OR = Operation ratio

TVC = Total variable cost

GI = Gross income

If operating ratio is 1, it means that, the gross income barely covers the expenses on the variable inputs used on the farm [9]. This could further mean that, such a business could survive only for short run and could collapse if correct adjustments are not made to improve the use of the variable resource in term of reducing the cost or increasing gross income.

Fixed Ratio

This is the proportion of the gross income that goes to pay for fixed cost. The lower the fixed ratio the better for the farm business. Fixed ratio (FR) is the total fixed cost (TFC) divided by the gross income (GI). This is calculated as;

$$FR = \frac{TFC}{GI} \quad (7)$$

Where;

FR = Fixed ratio

TFC = Total fixed cost

GI = Gross income

If the fixed ratio is greater than 1, some of the fixed resources are either not used or underutilized. A fixed ratio of less than 1 is desirable. However, in our traditional farming system, the operating ratio is more important than the fixed ratio because more of the resources used are variable while fixed items are almost negligible.

Multiple Regression Model

This was used in this study to identify and explain the variable inputs used to explain the variation in output. Three functional forms were fitted into the data these include: Linear production function, Semi –Log production function and Double-log production function. The implicit form of the production function is expressed as:

$$Y = f(X_1 + X_2 + X_3 + X_4 + X_5 + U \quad (8)$$

Where;

Y = Total output (N/kilograms)

X_1= Seed (N/kilograms)

X_2= Fertilizer (N/ kilograms)

X_3= Chemical (N/Liters)
X_4 = Labour (N/Man-days)
X_5 = Farm size (N/hectares)
U = Stochastic term represents the effects of the other variables that are not included in the model.

Productivity estimate

Economic theory states that a farm maximizes profit with respect to input if the ratio of its marginal value product (MVP) to its marginal factor cost (MFC) is equal to one or unity[11]. A ratio less than unity shows over utilization of the resources and ratio greater than unity indicates underutilization of the input and increasing the rate of that input, will increase the level of profit of the firm.

The MVP with respect to each input (seed, fertilizer, chemicals, labour, and farm sizeetc) was be obtained by taking the first order partial derivative of the total value product function when other inputs are held at their geometric means Thus:

$MVP.X_i = b_i.Py$ (9)
$MVPX = 1/y.dy/dx.py$ (10)
$MVP.X_i = b_i.x_i/y.Py$ (11)

Where:
$MVP.X_i$ = marginal value product of $_i$th input
x = Geometric mean of $_i$th input
py = Geometric mean of output price
b_i = regression coefficient.

III. Results and Discussion

Costs and returns in Fadama Farming

Table 1, shows the average production costs and returns for Fadama II Beneficiaries in the study area. The total cost of production incurred by Beneficiaries was ₦ 72,401.15 per hectare

The farm budget analysis revealed that variable costs accounted about 88.87% of the total cost of production incurred by the Fadama II beneficiaries in the study area. These finding is in agreement with those of Musa[12] and Baba and Wando [13] who in separate studies found variable costs accounting for 99.40% and 99% of the total cost of production, respectively. Furthermore, the finding is in line with CBN [14] and Bivan [15]who reported that over 60 percent of the average total cost of production was variable cost for both soya bean and cowpea enterprises and cotton production, respectively in Bauchi State. Similarly, Jirgi[16] reported that variable costs accounted for 96 percent of the total cost of production of sorghum in Zuru Local Government Area of Kebbi State.

The cost of labour input alone constituted 60.71% for Beneficiaries. This suggests that labour input is the most costly single item of vegetable production in the study area. This again, is in agreement with the finding of Baba [17] who found labour input in Bauchi State to have constituted 67.77%of total cost of production under small scale irrigation?

The fixed costs accounted for 11.13% among the Fadama II beneficiaries. The fixed cost was highe among the Beneficiaries due to wash bore, tube wells and water pumps given to the Beneficiaries on loan.

Also, the average total revenue per hectare was N168,985.85 for Beneficiaries. The returns on naira invested per hectare by Fadama II Beneficiaries in the study area was N2.33.

Financial Analysis

Financial analysis was used to determine the profitability level among Fadama II beneficiaries who are into vegetable production in the study area. The net farm income might be misleading because it may not be thetrue reflection of the amount of capital. Therefore, it becomes necessary to examine the three ratios i.e. gross, operating and fixed ratios which are also obtained from the net farm income statement.

The result of this study showed that gross ratios by Beneficiaries was 0.30. This indicates that the total cost of production was just about 30% of the gross returns for the Beneficiaries of Fadama II in the study area. The analysis further revealed that the operating ratio of Beneficiaries stood at 0.27, the fixed ratio for Beneficiaries was 0.03 which indicates that the fixed expenses accounted for 3% of the gross return among Fadama II Beneficiaries. This result clearly indicates thatvegetable production in the study area is a profitable venture because the entire ratios (gross, operating and fixed) obtained were less than one. The implication is that Beneficiaries minimized operating costs by 0.11% which result to increase in net return.

Production Function Analysis

To determine marginal productivities for resources used in Fadama farming and the efficiency of their usage, the production function was used. The production function initially estimated include linear, semi-log, and Double-log forms. The model with the best "fit" was selected on the basis of R^2, and "t" ratio and the signs on the estimated parameters. On the basis of these criteria, the Double-log function was chosen as the lead equation and was ultimately used for explaining the resource productivity and efficiency.

Table 2, shows the estimated regression coefficients and t-values for the Beneficiaries of Fadama II. The result shows that the value of R^2 is 53.6% forthe Beneficiaries.The percentages of the variation in the dependent variable that was explained by variation in explanatory variables such as; seed, fertilizer, chemical, labour and farm size included in the model for the groups of farmers. The result agrees with the finding of Danwanka and Ggala[18], who reported R^2 of 61.3%for beneficiaries ofFadama Project in Bauch State. It also agrees with the finding of Nasiru et al.,[19], who reported R^2 of 60.3% for Beneficiaries of FadamaII Project in Taraba State. The remaining proportion (46.4 percent and 24.6 percent) may be due to variation in the production techniques and other factors not included in the model (error or random disturbance).

The positive coefficient is an indication that increasing these variables by one percent either individually or collectively holding other variables constant, would lead to increase in the output,respectively. The negative coefficient, on the other hand, implies that an increase in any of the variables by one percent, holding others

constant, would lead to decrease in the Fadama farm yield by one percent.

The result revealed that seed was significant (P<0.05) for Beneficiaries. The coefficient for the farm size which was not significant agreed with the finding of Lenka et al.,[20] who reported that the total farm size did not significantly determine the proportion of potato output. In view of the fact that Cobb-Douglas function was selected, the regression coefficients also represent the elasticity of production with respect to the corresponding explanatory variables.The regression coefficient for seed input used by Beneficiaries, was 324.29 at (P<0.05), implying that 1 percent increase in seed input holding other inputs constant would increase vegetable yield by 324.29%.

Efficiency of Resource Utilization in Fadama Farming

The marginal value product (mvp) is the yardstick for judging the efficiency of resources used. A given resource is said to be efficiently utilized if its marginal valued product is just sufficient to offset its purchase price.

Table 3shows the estimated marginal value product (mvp), marginal factor cost and efficiency of resource use of beneficiaries of fadamaII project in the study area.

A ratio less than 1 shows over utilization of that input and so profit would be increased by decreasing the quantity used of that input. However, a ratio greater than one indicates underutilization of that input and increasing the rate of use of that input would increase the level of profit of the farm firm. For beneficiaries, the efficiency indices of resource use of seed and labour were greater than 1; this implies that these resources were underutilized. Fertilizer,chemical and farm size were less than 1 implying that, the resource were over utilized. For profit maximization, the use of seed and labour should be increased while fertilizer, chemical and farm size should be decreased.

For optimum profits, beneficiaries need to adjust their inputs use (seeds, fertilizer, chemical, labour and farm size) by 33.02, 0.13, 0.86, 0.3 and 0.87, respectively.

Constraints to Fadama-II project Implementation

Table 4: shows the distribution of the respondents according to constraints faced by Fadama II project beneficiaries in the study area. Constraints are problems encountered by Fadama farmers in the study area. Inadequate credit was the most (60%) serious problem that faced the Fadama II Beneficiaries in the study area. Although Beneficiaries obtained loan from Fadama II project, but 60 percent of them complained of inadequate credit. These findings agrees with Ochi [21], who reported that lack of formal credit by majority of business operators often hinders investment, especially in agriculture, where small size of the loan are dominant, concretes evidence shows that, among guaranteed agricultural loans awarded in Nigeria, an over whelming high percentage represents small size, although majority of the actual credit applications indicates large size.

Another important constraint faced by the beneficiaries was high cost of inputs, namely, fertilizer, herbicide, water pump machines etc. The result shows that 33.33 percent of Beneficiaries complained of the cost and shortage of these farm inputs Agwu and Anyanwu [22] reported that the development of sustainable production required increased use of purchased inputs such as seeds, fertilizer, equipment etc. However, acquiring these factors of production also demand the availability of adequate financial supports.

Land acquisition problem was a factor militating against Fadama farming activities in the study area. About 29 percent of Beneficiaries complained of land acquisition problem. Lenkan*et al* [23] posited that land tenure system is a major constraint in food crops production such that those farmers that do not have clear titles to land find it difficult to invest in large scale farming. Capacity building or training improve farm management practice and enhance effectiveness and efficiency, 21.33 percent of Beneficiaries were not trained on records keeping (sales records, credits records among others). The beneficiaries need to be trained on essential record keeping

Table1: Average production costs and returns for Beneficiaries of Fadama II Project (₦/ha)

Production variable	**Beneficiaries**		**t- value**
Variable cost	**Amount**	**%**	
Seed/seedlings	1,041.00	1.44	
Fertilizer	9,180.00	12.68	
Chemical	3,168.33	4.38	
Fuel	6,300.00	8.70	
Maintenance	3,200.00	4.42	
Bag/basket	500.00	0.69	
Labour	43,953.39	60.71	
Total variable cost	**64,342.72**	**88.87**	**37.377***
Fixed Costs:			
Rental value of land	3,182.15	4.40	
Depreciation on equipment	4,876.28	6.74	
Total fixed cost	**8,058.43**	**11.13**	3.599*
Total cost of production	**72,401.15**	**100.00**	20.115*
Gross income (TR)	241,387.		4.856*
Net farm income (NFI)	168,985.8 5		3.574*
Return on Naira invested	2.33		
Gross ratio	0.30		
Operating ratio	0.27		
Fixed ratio	0.03		

Source: Field data, 2012; * = significant at P < 0.05

Table 2: Estimated regression coefficients for Fadama Beneficiaries in Sardauna L.G.A

Variables	**Beneficiaries Coefficients**	**t-value**
Constant	-448408.35	- 1.661^{NS}
Seed	324.29	2.539*
Fertilizer	- 4.34	- 0.140^{NS}
Chemical	- 4.33	- 0.039^{NS}
Labour	0.20	0.214^{NS}
Farm size (ha)	124460.14	0.627^{NS}
R^2	53.6%	

Source: Field data, 2012 * = Significant at P< 0.05, NS = Not Significant

Table 3: Estimated MVP and MFC of Fadama farmers

Production Inputs	Beneficiaries		Efficiency
	MVP	MFC	MVP/MFC
Seed	324.29	10.129	32.02
Fertilizer	4.34	4.973	0.87
Chemical	4.33	30.564	0.14
Labour	0.20	0.154	1.30
Farm Size	12446.14	66435.234	0.187

Source: computed from computer print

Table 4:- Distribution of the respondents according to constraints

Constraint	Frequency	%	Rank
Inadequate credit	45	60.00	1st
Inadequate/high cost of input	25	33.33	2nd
Inadequate storage facilities	05	6.67	7th
Inadequate extension Agents	07	9.33	5th
Bad Road Network	03	4.00	9th
Land Tenure Problem	22	29.33	3rd
Poor access to market	01	1.33	11th
Problem of pest and disease	01	1.33	11th
High cost of labour	02	2.66	10th
Non-literacy problem	05	6.67	7th
Lack of training	16	21.33	4th
High cost of transport	06	8.00	6th

Source: Field survey, 2012 multiple responses

IV. Conclusion

The study aimed at analyzing the vegetable production by the Beneficiaries of National Fadama Development Project revealing that the Beneficiaries of Fadama II made an average net farm income of ₦168, 985.85 per hectare, while the gross and operating ratios of Beneficiaries was 0.30 and 0.27 implying profitability. It was also discovered that all the production inputs usedby Beneficiaries were either above or below the economic optimum level; hence adjusting to economic optimum level would result in increased profit.

Recommendations

Based on the finding the researchers wish to recommends the following:-

1. Adequate loan at subsidized interest rate should be provided for Fadama farmers in the study area.
2. Adequate farm inputs such as improved seed/seedlings, fertilizer, agro-chemicals, water pump machines etc. at a subsidized rate should be provided to farmers by private firms and government.
3. Efforts should be geared by the government and other stake-holders towards providing fadama lands to farmers on soft conditions as regards land leasing agreement.
4. Efforts should also be geared to organizing farmers into cooperatives in the study area, as this will enhance the delivery of agricultural extension services to farmers and help stimulate rural resource mobilization for agriculture.
5. Similar study should be carried out in other Local Government Areas in the State to determine the impact of Fadama II project among farmers in the State.

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